

INLAND NAVIGATION.

STAGE OF WATER IN RIVERS AND HARBORS.

The following table shows the danger-points at the various stations; the highest and lowest water for April, 1889, with the dates of occurrence and the monthly ranges:

Heights of rivers above low-water mark, April, 1889 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
Red River:						
Shreveport, La.	29.9		15 22.0		30 17.9	4.1
Arkansas River:						
Fort Smith, Ark. ...	22.0		23 13.2		14 5.1	8.1
Little Rock, Ark. ...	23.0		1-2 17.1		22, 23 8.4	8.7
Missouri River:						
Omaha, Nebr.	18.0		1 8.9		15 6.9	2.0
Leavenworth, Kans. ...	20.0		1 12.0		11 6.8	5.2
Kansas City, Mo. ...	21.0		4.5 10.1		13, 14, 15, 16, 26 7.9	2.2
Mississippi River:						
Saint Paul, Minn. ...	14.5		30 3.8		21, 22 2.5	1.3
La Crosse, Wis.	24.0		1 5.3		19-23 3.7	1.6
Dubuque, Iowa	16.0		1, 2, 3 7.4		29 4.5	2.9
Davenport, Iowa	15.0		4.5 5.3		29, 30 3.2	2.1
Keokuk, Iowa	14.0		20 6.8		29-30 3.6	3.2
Saint Louis, Mo.	32.0		24 16.3		13 9.3	7.0
Cairo, Ill.	40.0		25, 26 24.0		16 17.9	6.1
Memphis, Tenn.	34.0		1 19.0		19-20 14.2	4.8
Vicksburg, Miss.	41.0		4.5 30.2		24 23.0	7.2
New Orleans, La. ...	13.0		14 11.2		29 8.5	2.7
Ohio River:						
Pittsburgh, Pa.	22.0		14 15.3		25 3.7	11.6
Parkersburg, W. Va. ...	38.0		16 19.6		26 6.9	12.7
Cincinnati, Ohio	50.0		19 26.9		26, 27, 29 14.0	12.9
Louisville, Ky.	25.0		20 10.1		28 6.8	3.3
Cumberland River:						
Nashville, Tenn. ...	40.0		16 18.1		28 6.2	11.9
Tennessee River:						
Chattanooga, Tenn. ...	33.0		20 8.2		13 3.2	5.0
Monongahela River:						
Pittsburgh, Pa.	29.0		14 15.3		25 3.7	11.6
Savannah River:						
Augusta, Ga.	32.0		16 16.0		30 8.5	7.5
Willamette River:						
Portland, Oregon ...	15.0		29 6.0		4 2.6	3.4

ICE IN RIVERS AND HARBORS.

The following reports relative to ice in rivers and harbors, and opening of navigation for the season, have been made by Signal Service observers:

Saint Mary's River.—Sault de Ste. Marie, Mich.: the river was reported open from here north, and as far south as Mud Lake, on the 8th. Floating ice in river, 9th, and 11th to 15th. Navigation was opened 17th. The steam barge "Mercer" was the first boat to depart for Lake Superior on the 17th, and the steam barge "Osceola," from Michigan for Duluth, passed here on the same day.

Mississippi River.—Saint Paul, Minn.: steamer "Sydney," from Saint Louis, Mo., arrived here at noon, 6th. She was the first through boat of the season.

Lake Ontario.—Oswego, N. Y.: schooner "Caroline March," from Port Hope, Columbia Co., Wis., arrived in this port 1 p. m., 4th, opening navigation for the season. Rochester, N. Y.: navigation was reported open, 18th.

Lake Huron.—Port Huron, Mich.: steam barge "Hall" arrived here on the morning of the 5th from Alpena, Mich. She was ten hours working her way through the ice, and sunk, from injuries received during the passage, as she reached the mouth of Black River. This was the first boat of the season to cross Lake Huron. Fort Gratiot Light was lighted for the first time this season on the 5th. The steamer "Atlantic" was reported fast in the ice near Lakeport, Mich., 7th; she was released on the 9th. 15th, the ice which had been driven out of the lake jammed at the Saint Clair flats to such an extent as to entirely stop navigation; the steamer "Al-

pena" becoming fast in the ice at that point. At Marine City a large fleet of vessels was ice bound, being unable to proceed south. The ice jam broke during the night of the 19th, and the vessels detained there moved out. Owing to the large number of vessels, and the haste to move out, several minor casualties occurred.

Thunder Bay.—Alpena, Mich.: steamer "Atlantic," from Detroit, Mich., arrived here, 5th; this being the first arrival of the season, navigation is considered fully opened.

Lake Erie.—Buffalo, N. Y.: 12th, steamer "Owego" cleared for Chicago, Ill., and navigation for the season is considered opened. The harbor was full of floating ice on the 4th, 9th, 11th, and 12th. The lake and harbor were free of ice, 25th. Cleveland, Ohio: navigation was opened on the 1st. Detroit, Mich., 5th: the lake is reported free of ice, and the boats of the Detroit and Cleveland Steam Navigation Company have resumed their regular trips for the season.

Lake Michigan.—Grand Haven, Mich.: navigation on the lake was resumed, 15th. Green Bay, Wis.: steamer "De Pere" arrived, 9.30 a. m., 8th, from Chicago. She was the first arrival of the season, and was also the first departure, leaving the same evening.

Lake Superior.—Marquette, Mich.: navigation opened, 21st. Duluth, Minn.: propeller "James Fisk, jr.," departed on the 18th for Buffalo, N. Y. She was the first departure of the season for the lower lakes. The steamer "Osceola," from Port Huron, Mich., arrived in this port 4.40 a. m., 20th. She was the first arrival of the season from the lower lakes.

HIGH TIDES.

Norfolk, Va.: during the storm of the 6-7th the northeasterly wind backed up the water into Chesapeake Bay and caused the tide to rise to an extraordinarily high point, flooding the lower streets in this city. The tide rose to a point higher than ever before seen here, being between six and seven feet higher than the ordinary high water mark, and twelve inches higher than the highest tide hitherto known—that during the great gale of August, 1879. The water was blown out of Albemarle Sound lowering the water in the canal until vessels got aground where they should have had two feet of water to spare. This was due to the gale being immediately followed by a strong westerly wind.—*Report of Branch Hydrographic Office, Norfolk, Va.*

Suffolk, Va.: the storm of the 6th was the fiercest and most destructive ever known in this section. The tide in the Nansemond River was unprecedented, and on the 7th the river extended over its banks on each side for a hundred yards or more. Considerable damage was done to wharf property and to goods stored in warehouses along river. The track of the Suffolk and Carolina Railroad along river was washed from the roadbed and considerably damaged.—*Richmond Dispatch*, 8th.

Hatteras, N. C.: a very high tide submerged Hatteras Island on the 7th, and water entered many houses. Trees were uprooted, fences demolished, and gardens ruined. It is stated that this tide was the highest that has occurred since Hatteras Inlet was cut out in 1846.

Cedar Keys, Fla.: high wind, with an extreme velocity of sixty miles per hour prevailed during the 14th. The wind caused the tide to rise very high, damaging many small craft, and floating away a considerable number of cedar logs from the saw mill yards.

High tides also occurred as follows: Cape Henry, Va., 8th, 15th, 16th; Norfolk, Va., 16th.

ATMOSPHERIC ELECTRICITY.

AURORAS.

The most notable auroral displays were reported on the 7th, when they were noted in New England, New York, Pennsyl-

vania; Ohio, and Dakota, and on the 27th, when they were observed in northern Illinois, Iowa, Minnesota, and Dakota. Auroras were reported as far south as southern Ohio. The

following are descriptions of auroras noted on the 7th and 27th, respectively:

An aurora was observed throughout northern New England from 9 p. m., 7th, to 3 a. m., 8th. An aurora was seen in northern Vermont on the 20th.—*Bulletin of the New England Meteorological Society.*

Eastport, Me.: a faint auroral arch, extending from northeast to northwest and to altitude 30°, was observed at 8 p. m., 7th. The display became very brilliant at 9.30 p. m., and ended at 11.45 p. m. Waves or beams of light shot up towards the zenith every few seconds, producing a most brilliant display.

Northfield, Vt.: an aurora was observed from 8.23 p. m. to 9.25 p. m., 7th, extending from northeast to north-northwest. Streamers rose to altitude 15°, with a dark cloud, luminous in spots, underneath. Another aurora was observed, 8.25 p. m., 22d. It resembled the one mentioned above, and lasted twenty minutes.

Number Four, Lewis Co., N. Y.: a brilliant auroral display became visible soon after dark on the 7th. It consisted of an arch of dark color, the ends of which touched the horizon, and its centre rose to altitude 15°. Above this arch a second one formed; it was of a uniform width and of a fiery red color. A third one appeared above the other two, from which streamers shot constantly upward during the display. The aurora attained its maximum brilliancy about 8.40 p. m. At 9.30 p. m. the arches had nearly disappeared, and there was but a diffusion of light from northwest to northeast.—*Report of voluntary observer.*

Saint Vincent, Minn.: an auroral display was observed 10.10 p. m., 7th. It consisted of a diffused white light which rose to altitude 45° and extended from azimuth 125° to 250°. This arch disappeared at 11.40 p. m. and was succeeded by a low irregular arch of very bright light, having an altitude of 8° and extending from azimuth 160° to 210°. Another auroral arch was observed 10.40 p. m., 27th, the arch extending from azimuth 120° to 160° and to altitude 6°. The light increased steadily in brilliancy until it attained its maximum intensity at midnight, at which time the arch had risen to altitude 15° and covered 150° of the horizon.

Fort Buford, Dak.: a faint auroral display began 10.48 p. m. and ended 11.55 p. m., 7th. It consisted of an arch about 3° in width which rose to altitude 45° and extended over 90° of the horizon from northwest to northeast. No changes of any note occurred during the display, except that the arch at times became slightly brighter. Another aurora was observed 10.26 p. m., 27th. It consisted of a well-defined arch of straw color, extending from northwest to within a few degrees of east, and rose to altitude 30°. Its maximum intensity occurred at 12.17 a. m., 28th. The light had a motion from west to east. The display ended 3.15 a. m., 28th.

Moorhead, Minn.: a very brilliant, steady, white arch of light, with occasional streamers of a pale rosy color, was observed 11 p. m., 27th. The arch extended from about azimuth 100° to 260°, and rose to altitude 40°. The aurora remained visible until daybreak 28th.

Fort Sully, Dak.: an auroral light, of a pale yellow color, was observed 10.15 p. m., 27th. It extended from azimuth 158° to 202°, and rose to altitude 10°. The light remained of a uniform color and intensity during the remainder of this date. The display ended during the night.

Auroras were observed during the month as follows: 4th, Pekin, Ill. 7th, New Hartford, Conn.; Fort Buford, Dak.; Eastport, Kent's Hill, and Orono, Me.; Amherst, Blue Hill Observatory, Newburyport, and Royalston, Mass.; Port Huron, Mich.; Saint Vincent, Minn.; North Sutton, N. H.; Madison, N. J.; Constableville, Ithaca, Barnes' Corners, and Wedgwood, N. Y.; Collinwood, Lordstown, and Vienna, Ohio; Eagle's Mere, Le Roy, and Rimersburgh, Pa.; Northfield, Vt. 8th, Nashua, N. H.; Lyons, N. Y.; Dayton and Clarksville, Ohio. 9th, Dayton, New Alexandria, and Portsmouth, Ohio; Greenville, Pa. 10th, Logan, Ohio. 14th, Pekin, Ill.; Clarksville, Ohio. 20th, Kent's Hill, Me.; Saint Vincent, Minn. 22d, Northfield, Vt. 27th, Fort Sully, Carlington, Fort Buford, Garden City, Kimball, and Webster, Dak.; Mount Morris and Winnebago, Ill.; Manson, Iowa; Duluth, Moorhead, and Saint Vincent, Minn. 29th, Ames, Iowa. 30th, Pekin, Ill.; Wedgwood, N. Y.

THUNDER-STORMS.

The more severe thunder-storms are described under "Local storms." Thunder-storms were reported in the greatest number of states and territories, twenty-eight, on the 12th; in nineteen on the 20th; in eighteen on the 19th; in sixteen on the 11th, 21st, and 24th; in from ten to fifteen, inclusive, on the 1st to 3d, 6th, 13th, 14th, 17th, 18th, 22d, 23d, 25th, 26th, 28th, and 29th; in from five to nine, inclusive, on the 9th, 10th, 15th, 16th, and 30th, and in less than five on the 4th, 5th, and 8th. There were no dates for which thunder-storms were not reported in one or more states or territories.

Thunder-storms were reported on the greatest number of dates, twenty-one, in Texas; on seventeen in Missouri; on fifteen in Kansas and Louisiana; on thirteen in Ohio; on twelve in Indian Territory and North Carolina; on eleven in Alabama and Nebraska; on from five to ten, inclusive, in Ark., Cal., Colo., Conn., Dak., Fla., Ga., Ill., Ind., Iowa, Ky., Me., Md., Mass., Mich., Minn., Miss., N. J., N. Mex., N. Y., Oregon, Pa., S. C., Tenn., Va., Wis.; on less than five in Ariz., Del., D. C., Mont., N. H., R. I., Utah, Vt., W. Va., Wyo. In Idaho, Nevada, and Washington Ter. no thunder-storms were reported.

MISCELLANEOUS PHENOMENA.

PRAIRIE FIRES.

Rapid City, Dak.: a prairie fire started at the northeastern limit of the city at 2.45 p. m. 2d, and swept six miles down the valley before it was extinguished. The high wind caused the fire to travel at a fearful rate. Several ranches in the track of the fire were completely demolished; one person was burned to death and several injured.

Yankton, Dak.: during the high wind on the 2d, smouldering prairie fires were fanned, and extended into the city, consuming several buildings near the boundary. Prairie fires also prevailed north of the city on the 1st, and to the north and east on the 2d and 3d.

Fort Buford, Dak.: prairie fires were observed on the south side of the Missouri River on the 19th. Prairie fires were also observed three miles east of this place 26th; the wind, which

was high from the northwest at the time, caused the fires to sweep rapidly to a belt of cottonwood timber along the river, setting fire to the timber, consuming all the low brush, and injuring the larger trees. The fires are supposed to have caught from sparks of locomotives.

Fort Sully, Dak.: it is reported that very destructive prairie fires swept over the eastern portion of this (Sully county) on the 2d and 3d. The fires were pushed onward before a gale, which at times blew at the rate of sixty miles per hour, and progressed fifteen to thirty miles per hour. Many farmers have been rendered entirely destitute by the fires, having lost all seed, farming implements, houses, and live stock. A careful estimate places the loss of property of all kinds, in this county, at from \$50,000 to \$75,000.

Prairie fires were also reported as follows: Wolsey, Dak., 15th, 17th, 18th; Fort Sill, Ind. T., 1st to 6th, 27th; Fort